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The Economic Efficiency Trend of Date Orchards in Saravan County

Ali Sardar Shahraki*[1], Mohammad Hoseyn Karim[2]

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Abstract

The purpose of this study is to evaluate the efficiency of date growers in Saravan County using non-parametric methods. The measurement of date farmers' efficiency and the comparison of their performance to with one another can play an important role in improving their efficiency and productivity. One of the common methods to measure efficiency is data envelopment analysis (DEA). Despite its advantages, this method cannot measure efficiency in a sound way when few decision-making units (DMUs) are available. Therefore, DEA window analysis approach is used to ramp up the number of DMUs in order to make it possible to measure the efficiency of the farmers. This study used DEA window analysis approach to determine date growers' efficiency in Saravan County over 2012-2016. The results show that the efficiency score of farmers is <1, which indicates their inefficiency so that means efficiency score was found to be 0.93, 0.92 and 0.95 per year in Zaboli, Sib and Suran districts, respectively. Technological change was one of the most influential factors in changing total productivity of agriculture. It is, therefore, suggested that modern technologies be adopted to enhance the efficiency of date production in the studied region.

Keywords: Efficiency, Data Envelopment Analysis, DEA Window Analysis Approach, Date, Saravan.

JEL Classification: Q10, Q13, N5.

1. Introduction

Efficiency and productivity are two major issues in economy that are focused on by economists – along with their attempts to achieve economic growth, price stability and unemployment rate mitigation.

Among all Production economics is concerned with determining the efficiency of farms and agricultural production units and comparing

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1. Department of Agricultural Economics, University of Sistan and Baluchestan, Zahedan, Iran (Corresponding Author: A.s.shahraki@Eco.usb.ac.ir).

2. Department of Economics, Kharazmi University, Tehran, Iran (karimsistani482@gmail.com).

them over a fixed period of time (Dahmardeh & Sardar Shahraki, 2015). The accomplishment of efficiency requires both the efficient allocation of resources and factors of production. Especially in the contemporary world that is faced with the fast-paced development of countries and the dramatic growth of production, the survival of all manufacturing and service enterprises depends on the revision and improvement of mechanisms for optimal allocation of these scarce resources (Afkhami Ardakani et al., 2011).

Scarcity of production factors forms the basis of economics and at various times, under any circumstances, will always produce limited amounts of inputs in which both human and non-human resources are available. Countries on a lack of resources limited opportunities for development and on the other hand adoption of a better technology faces the existing technologies that do not use it efficiently. The types of natural hazards, social, economic and willful hands and a fragility and vulnerability to the producers of this section, presented the final result of the instability of their income. Due to the natural and economic conditions of production of agricultural productions in the context, economic activities are one of the most risky ones, Since a major part of agricultural producers in the country, the average and median farmers, however, have limited financial and property in any given period of operation in the production process, they're sometimes even the least damaged possible void and imposed on them a miserable life (Dahmardeh & Sardar Shahraki, 2015).

Efficiency and productivity are related to the input and output ratios of an economic system (Farrel, 1957). Efficiency can be defined as the ability of an enterprise to derive the maximum outputs from a given set of inputs assuming a certain technology, or as the capability of an enterprise to produce a certain return with the minimum available inputs; productivity is a concept that reflects the efficiency of enterprises versus one another over a fixed period of time (Mehrabhi Bashrabadi & Pakravan, 2009). On the other hand, productivity in broader sense is the ratio of outputs to inputs. In other words, productivity means the average production per unit of total inputs, so that higher average production per unit of inputs implies higher productivity and lower production reflects the loss of productivity (Mohammadpour Hengrvani & Arsalanbod, 2015).

Agricultural sector is one of the most important economic sectors that is considered by planners as the focal point of economic development programs. This activity sector plays a major role in terms of additional value and its contribution to GDP, employment generation for the active population, food security for the community, and the supply chain for the industrial sector. So obviously, the ignorance of this important sector of activity will have negative effects on other sector's economy. In general, the development of the agricultural sector emphasizes that in order to achieve sustainable development, it is necessary to strengthen the agricultural sector's position in terms of food supply, value added and effective employment among other sectors of the economy. Obviously, this is only possible through accurate knowledge of existing capabilities, promotion of the level of efficiency, and the optimal use of production factors such as capital, human resources and technology by the agricultural activities (Sardar Shahraki, 2016).

To better understand the quantity and quality of agricultural production changes, it is necessary to use indicators such as efficiency, productivity, relative advantage, and competitiveness, among which efficiency is a combined indicator that is recommended for evaluations because it establishes a link between inputs and outputs (Shahnavazi, 2017). Enhancement of efficiency enables the improvement of production efforts and production growth. In this sense, consideration of productivity criteria and the estimation of its related indicators can be a useful guideline to find the correct way of effective use of production factors in the age of resource scarcity (Akbari & Rajkesh, 2003).

Given the importance of date production and the potential of the region for its growth and production, the present methods for enhancing date production, including increasing the key production resources (e.g. land, water and capital) or the development of modern technologies, do not seem feasible in short run due to the date farmers’ inherent problems and poor economic conditions. Nevertheless, it is possible to increase date production and date its growers’ income with the current level of resources and technology availability. The present study focuses on the efficiency of date farmers and their profitability and evaluates their current status and the need for dealing with the efficiency issues to economize this activity. In this regard, the present project seeks to answer the following questions: 1) Do date orchards in Saravan County (the districts of Zaboli, Sib, & Suran) in Iran enjoy proper technical efficiency? 2) What level of efficiency do individual orchards have? (Are they efficient, inefficient, or low efficient?)

1.1 Research Objectives

Therefore, the objectives of this research can be listed as:

- To determine the technical efficiency of date production units in Zaboli, Sib & Suran districts.
- To determine efficiency scores of date gardens (if they are efficient, inefficient, or low efficient).

The paper is organized as below. Section 2 presents a review of most recent, relevant literature. Section 3 discusses the materials and methods in which the DEA-window analysis is described. We present the results and discuss them in Section 4. Finally, Section 5 is devoted to the conclusions.

2. Review of Literature

This section briefly reviews similar studies. Croppenstedt (2005) determined the technical efficiency of wheat growers in Egypt using the Cobb-Douglas frontier production function. They found that the average technical efficiency of wheat farmers in the studied region was 81% and only technical knowledge of irrigation was the determinant of the technical efficiency among the socio-economic characteristics such as age, gender, irrigation technical knowledge and access to farmer credit. Stating that rice production is inherently risky, Villano et al. (2006) used stochastic frontier production functions (Translog and polynomial function forms) to analyze simultaneously technical inefficiency and production risk of 46 rice farmers in Central Luzon, the Philippines by a data series for an eight-year period. The results showed that the average technical efficiency was 79% over the studied period and the average product was significantly affected by the rice acreage, labor and fertilization rate. Speelman et al. (2008) used the data envelopment analysis to analyze the efficiency of irrigation consumption in South African Farms and the factors affecting it. The results showed that the average water efficiency under constant and variable returns to scale were 43 and 67%, respectively. Factors like irrigation practices, land ownership, land size, and crop selection were effective on efficiency of irrigation system. Yilmaz et al. (2009) explored irrigation efficiency in Menderes basin of Turkey using the data envelopment analysis. They evaluated the efficiency of decision-making units with respect to weight restrictions specified on the basis of value judgments. Tozer (2010) examined the efficiency of wheat growers in Western Australia using data from 2004 to 2007 and stochastic frontier analysis method. According to their results, regional wheat growing inefficiency has increased from 18% in 2004 to 29% in 2007. Therefore, government's targeted programs to improve productivity have failed. Simelane et al. (2011) focused on the role of cooperatives in the production and marketing of dairy products. By determining the transaction costs involved in the production of dairy products, they use a simple multivariate regression model, taking into account the quantity of the product supplied by the farmer in the market as an dependent variable, membership in the cooperative as an imaginary independent variable and the use of a variety of other control variables concludes that cooperatives play an essential role in reducing transaction costs. In a study on identifying factors influencing the success of rural production cooperatives using analytic hierarchy process (AHP), Wang et al. (2012) investigated the efficiency of agricultural cooperatives and the factors influencing them in Langao, China. The results showed that the horticultural and vegetable cooperatives had higher technical efficiency than the livestock farming cooperatives and that the former cooperatives could improve their efficiency by making more use of vehicles. Huang et al. (2013) examined the technical efficiency of agricultural cooperatives in China using data envelopment analysis. They blamed managers’ technical inefficiency for the main cause of technical inefficiency. Also, they found that the size of the financial leverage and the number of board members were factors that negatively affected the technical efficiency of the cooperatives.

Mozafari (2015) focused on the economic efficiency of agricultural cooperatives in Buin Zahra County, Iran and prioritized their problems in the management process and marketing system. Their recommendations to cope with the problems of these cooperatives and their efficiency improvement can be summarized as doing locating studies prior to cooperative establishment, providing low-interest loans and facilities to animal farms, transfer of experiences and expertise of successful cooperatives to inefficient cooperatives, and supporting the marketing system. Karimi and Jalili (2017) studied the agricultural water productivity indices for main crops in Mashhad Plain, Iran. They reported the three top priority crops as onion, tomato and sugar beet in terms of the CPD index and as potato, onion and tomato in terms of the BPD and NBPD indices. According to their results, crops with higher water demand and lower economic return such as alfalfa should be eliminated from the cropping pattern. Shahnavazi (2017) worked on determining the efficiency rank of irrigated crops in agricultural sector. According to their findings, if the goal of irrigated farming is to increase profitability, the priority should be given to the growing of vegetables, industrial crops, summer crops, cereals, forage crops and grains respectively, but if the goal is to increase total production, the growing of forage crops, vegetables, industrial crops, summer crops, grains and cereals should be prioritized respectively. Latruffe et al. (2017) explored the impact of subsidies on the technical efficiency of European dairy farms and indicated that the impact of subsidies on technical efficiency can be either negative or positive depending on the country. Akamin et al. (2017) analyzed the efficiency and productivity of medicinal herbs in root and tuber systems in humid tropics of Cameroon using stochastic frontier analysis. The results showed that farmers were less efficient because of the increased size of the farm. Also, smallholder farmers' access to fertilizers and the increased participation of women in vegetable planting would have great benefits for vegetable production efficiency in Cameroon.

The review of literature shows that no research has been carried out on the window efficiency of agricultural activities. Investigation into window efficiency can shed light on the improvement of the quality and quantity of agricultural production by using a certain amount of production factors and/or reducing the cost of using of production factors with the aim of achieving a certain level of production. On the other hand, the window approach is one of the newest measurement methods of efficiency. This approach measures the performance of individual farmers over time as if they have distinctive identities across various time periods. This approach helps evaluate the performance of individual farmers over time.

3. Materials and Methods

The theoretical framework of efficiency is actually based on the optimization of the producer’s behavior or, in other words, the theory of production in the microeconomics. The concept of efficiency and the methods of its calculation can be approached from different perspectives of production theory. The process of optimizing a manufacturing enterprise can be investigated in two ways: (i) via profit tracking, or (ii) on the basis of cost minimization process. Efficiency is measurable in both views. In the theory of production, the optimal behavior of an enterprise is analyzed based on a series of initial assumptions on which basis of the hypotheses regarding a producer’s behavior are tested. Most empirical evidence shows that producers have not always succeeded in solving their optimization problems and do not enjoy a perfect performance in terms of efficiency. In addition to this assumption, even if they are technically efficient, it will not imply that they are not perfectly efficient in other aspects (Kumbhakar, 1993; Kumbhakar et al., 2000).

3.1 Window Data Envelopment Analysis Approach

The window data analysis was introduced for the first time by Charnes who named it window analysis. This approach analyzes the performance of each decision-making unit (DMU) over time as if it has a different identity at different time periods. It helps to track the performance of each DMU over time (Yang and Chang, 2008). The window analysis approach allows distinguishing pure technical efficiency, technical efficiency, and scale efficiency. On the other hand, since this approach creates a higher degree of freedom for the sample, it is very suitable for small sample sizes. There is no basic theory or logic about the definition and size of window. Most studies use a 3-5 year window. The window analysis is based on moving average. For example, the first window consists of the years 2011, 2012, …, and 2015. In the second window, 2011 is deleted and 2016 is added. Similarly, in the third window the years 2013, 2014, …, 2017 are assessed and this pattern is kept until the last window (Asmild et al., 2004). As Kumbhakar and Lovell (2000) have argued, cross-sectional data provides a glimpse of the state of the producers and their efficiency. The panel data provides more reliable results on the producer's performance since it enables the assessment of a producer's performance within a given time interval. Data Envelopment Analysis (DEA) was first used for cross-sectional data. In this framework, a decision maker is compared with all units that operate in the same time period and the role of time is not considered. Panel data are preferred over cross-sectional data because not only can one decision maker be compared to another decision maker, but also the change in the efficiency of a particular decision maker can be evaluated over time (Sokhanvar et al., 2011).

For the aim of formulation, assume *N* DMU's $(n = 1, \dots, N)$ that are observed in *T* periods $(t = 1, \dots, T)$ and all consume *r* inputs to produce *s* outputs. Thus, the sample has N × T and one observation *n* in period *t*, and DEA_t^n has one *r*-dimensional input vector $X_t^n = (x_{1t}^n, x_{2t}^n, \dots, x_{rt}^n)t$ and one *s*-dimensional output $Y_r^n = (y_{1r}^n, y_{2r}^n, \dots, y_{st}^n)$.

Window is shown in K $(1 \le K \le T)$ time and has $N \times W$ observations. The input matrix for the DEA-window analysis is as follows:

$$X_{KW} = (x_k^1, x_k^2, \dots, x_k^N, x_{k+1}^1, \dots, x_{k+w}^1, x_{k+w}^2, \dots, x_{k+w}^N) \tag{1}$$

and the output matrix is as below:

$$Y_{KW} = (y_k^1, x_k^2, \dots, y_k^N, y_{k+1}^1, \dots, y_{k+w}^1, y_{k+w}^2, \dots, y_{k+w}^N) \tag{2}$$

Input-oriented DEA-window problem for DUE_t^n under the assumption of constant return is given as below:

$$
\begin{aligned}
&\underset{\lambda,\theta}{Min}\ \theta = \theta'_{kwt} \\
&S.t: \\
&\quad -X_{kw}\lambda + \theta X_t \geq 0 \\
&\quad Y_{kw}\lambda - \theta Y_t \geq 0 \\
&\quad \lambda n \geq 0 \\
&\quad (n = 1.k\ ,\ N \times W)
\end{aligned}
\tag{3}
$$

Figure 1 depicts input-oriented window DEA with two inputs and a constant output. It shows two DMUs *d* and *e*, each of which has been observed at four different times, $t = 1, \ldots, 4$. The window l_2 is a window that starts with the window width of 2 at time 1 and includes the observations e_1, e_2, d_1, and d_2 where it has a frontier shown as l_2 (Asmild et al., 2004).

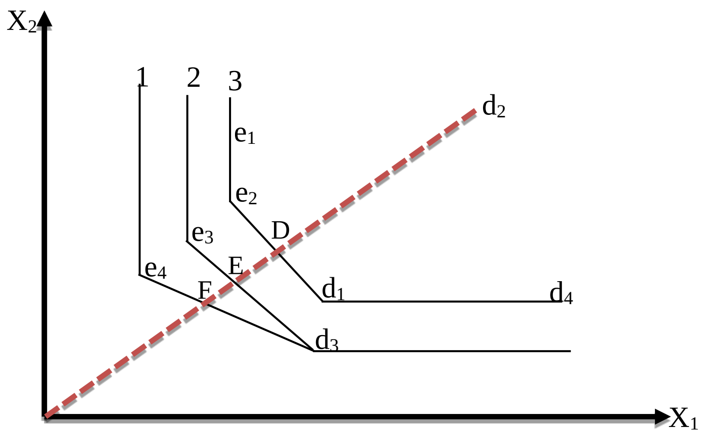

Figure 1: DEA Window Analysis

After the multiplier constraints are included in the model, the linear programming problem is derived as follows:

$$
\begin{aligned}
&\underset{\lambda,\theta}{Min}\ \theta = \theta'_{kwt} \\
&S.t: \\
&\quad -X_{kw}\lambda + \theta X^{t} + C_Z^{i} \geq 0 \\
&\quad Y_{kw}\lambda - \theta Y^{t} + C_Z^{0} \geq 0 \\
&\quad \lambda_n \geq 0 \\
&\quad Z \geq 0 \\
&\quad (n = 1.k\ ,\ N \times W)
\end{aligned} \tag{4}
$$

3.2 Data

The statistical population was composed of date farmers of Saravan County located in southern Sistan and Baluchistan province of Iran in three districts of Zaboli, Sib and Suran. For data collection, a questionnaire was developed and then, it was filled out by growers in an interview. To do this research, 45 questionnaires were administered to the date farmers in three studied districts in 2011-2016. The sample was taken by a two-stage cluster method in which the main clusters were composed of these districts and the sub-clusters included date growers.

Input indicators are the factors that reduce efficiency when one unit of them is added to the system, assuming that other conditions are constant. Output indicators are the factors that increase efficiency by adding one unit to the system, assuming that other conditions are constant (Siriopoulos & Tziogkidis, 2010). The first step to assess the relative efficiency using DEA-window model is to select the input and output indicators of the model using multi-criteria decision-making models. Table 1 presents the input and output indicators of the data window analysis model.

Table 1: Inputs and Outputs of DEA Window Analysis Model

Descriptive	Variable	
Inputs	Planting area (ha)	X_1
	Recruited labor (person-hour)	X_2
	Family labor (person-hour)	X_3
	Irrigation frequency	X_4
	Manure (kg)	X_5
	Chemical fertilizer (kg)	X_6
	Age (year)	X_7
	Educational level	X_8
	Experience (year)	X_9
	Family size (person)	X_{10}
	Non-date growing activities	X_{11}
	Number of land parcels	X_{12}
	Inter-tree spacing (m)	X_{13}
	Attendance in promotional courses	X_{14}
	Orchard size (number of trees)	X_{15}
Output	Profit	Y_1
	Production yield	Y_2

4. Results & Discussion

To assess date farmers, this study used output-oriented DEA-window analysis assuming variable return to scale. The output-oriented approach was selected because the growers apply a constant amount of resources for date growing, but they attempt to maximize its output. Thus, the growers have no remarkable role in determining the inputs, but their outputs depend on the activities and how resources are allocated to different sections. Therefore, the output-oriented models are more appropriate for their evaluation. Also, variable returns to the scale were selected because no evidence shows constant return to scale for the operations of the growers and thus, the return to scale should be left open so that the type of return to the scale of the farmers is determined in DEA models. The results of the estimation of the data analysis model for date growers are summarized in Tables 2, 3 and 4. In DEA-window approach, the efficiency of the enterprises is estimated for each period and across the windows for specific time periods. Then, the column average is computed for each individual period. Finally, the values obtained from the average efficiency of the windows of each enterprise over the assessed period create the basis for evaluating and comparing the performance of the enterprises.

Table 2: Performance Measurement Results Using Window Data Envelopment Analysis Technique

Beneficiaries		2012	2013	2014	2015	2016	The average efficiency of each window	Average performance every year
Operator 1	W1	0.99	1.00	1.00	1.00		0.99	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 2	W1	0.90	1.00	1.00	1.00		0.97	
	W2		1.00	1.00	1.00	1.00	1.00	0.98
Operator 3	W1	1.00	1.00	1.00	0.95		0.98	
	W2		1.00	1.00	0.95	0.99	0.98	0.98
Operator 4	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	0.81	0.95	0.97
Operator 5	W1	0.81	0.97	1.00	1.00		0.94	
	W2		0.97	1.00	1.00	0.70	0.92	0.93
Operator 6	W1	0.99	1.00	0.95	1.00		0.98	
	W2		1.00	0.95	1.00	0.68	0.90	0.94
Operator 7	W1	0.89	1.00	1.00	1.00		0.97	
	W2		1.00	1.00	1.00	0.99	0.99	0.98
Operator 8	W1	0.99	1.00	1.00	1.00		0.99	
	W2		1.00	1.00	1.00	0.99	0.99	0.99
Operator 9	W1	0.99	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	0.99	0.99	1.00
Operator 10	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	0.90	0.98	0.99
Operator 11	W1	0.78	1.00	1.00	0.78		0.89	
	W2		1.00	1.00	0.78	1.00	0.95	0.92
Operator 12	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 13	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	0.81	0.95	0.98

Operator 14	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 15	W1	1.00	1.00	1.00	0.83		0.96	
	W2		1.00	1.00	0.83	0.89	0.93	0.94
Operator 16	W1	0.97	1.00	0.82	0.98		0.94	
	W2		1.00	0.82	0.98	1.00	0.95	0.94
Operator 17	W1	1.00	1.00	0.78	1.00		0.94	
	W2		1.00	0.78	1.00	1.00	0.94	0.94
Operator 18	W1	1.00	1.00	0.74	1.00		0.94	
	W2		1.00	0.74	1.00	1.00	0.94	0.94
Operator 19	W1	0.91	1.00	1.00	1.00		0.98	
	W2		1.00	1.00	1.00	0.78	0.94	0.96
Operator 20	W1	1.00	0.70	0.60	1.00		0.83	
	W2		0.70	0.60	1.00	1.00	0.83	0.83
Operator 21	W1	1.00	0.69	1.00	1.00		0.92	
	W2		0.69	1.00	1.00	1.00	0.92	0.92
Operator 22	W1	0.97	1.00	1.00	0.95		0.98	
	W2		1.00	1.00	0.95	1.00	0.99	0.98
Operator 23	W1	1.00	0.72	1.00	1.00		0.93	
	W2		0.72	1.00	1.00	1.00	0.93	0.93
Operator 24	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	0.97	0.99	1.00
Operator 25	W1	0.99	1.00	0.97	0.95		0.98	
	W2		1.00	0.97	0.95	1.00	0.98	0.98
Operator 26	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 27	W1	1.00	1.00	0.89	1.00		0.97	
	W2		1.00	0.89	1.00	0.91	0.95	0.96
Operator 28	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 29	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 30	W1	1.00	0.89	1.00	1.00		0.97	
	W2		0.89	1.00	1.00	0.97	0.96	0.97
Operator 31	W1	1.00	1.00	0.78	1.00		0.94	
	W2		1.00	0.78	1.00	1.00	0.94	0.94
Operator 32	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 33	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	0.99	1.00	1.00

Operator 34	W1	1.00	0.78	1.00	1.00		0.95	
	W2		0.78	1.00	1.00	1.00	0.95	0.95
Operator 35	W1	1.00	1.00	1.00	0.82		0.95	
	W2		1.00	1.00	0.82	1.00	0.95	0.95
Operator 36	W1	1.00	1.00	0.97	0.70		0.92	
	W2		1.00	0.97	0.70	1.00	0.92	0.92
Operator 37	W1	0.70	1.00	1.00	0.69		0.85	
	W2		1.00	1.00	0.69	1.00	0.92	0.88
Operator 38	W1	0.82	1.00	1.00	1.00		0.95	
	W2		1.00	1.00	1.00	1.00	1.00	0.98
Operator 39	W1	0.70	1.00	0.95	0.60		0.81	
	W2		1.00	0.95	0.60	1.00	0.89	0.85
Operator 40	W1	0.69	1.00	0.88	1.00		0.89	
	W2		1.00	0.88	1.00	1.00	0.97	0.93
Operator 41	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 42	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 43	W1	1.00	1.00	1.00	1.00		1.00	
	W2		1.00	1.00	1.00	1.00	1.00	1.00
Operator 44	W1	0.90	1.00	1.00	0.95		0.96	
	W2		1.00	1.00	0.95	1.00	0.99	0.98
Operator 45	W1	1.00	0.99	1.00	1.00		1.00	
	W2		0.99	1.00	1.00	0.70	0.92	0.96

Source: Research findings

The analysis of date growers' efficiency in Zaboli District of Saravan County (Table 3) versus the inputs used by them reflects that their average efficiency was almost equal and relatively high in different years in 2012-2016. On the other hand, their average efficiency across the years was found to be 0.93, implying the high level of their profit and production yield per unit area.

Table 4 summarizes the estimations of efficiency scores by window analysis method for Sib District. As one can see, the efficiency of the studied 45 date growers in Sib District as averaged over the studied time was found to be 0.92. Considering the inputs used over this period, their efficiency is close to 1, showing their high efficiency and yield per unit area. Also, they earned high profit. Their efficiency was almost constant over the studied time period.

Table 3: Results of Estimation of Efficiency Using DEA-window Analysis Technical in Zaboli District

Time Interval	2012	2013	2014	2015	2016	Mean Efficiency Per Window	Mean Efficiency Per Year
Mean	0.96	0.92	0.91	0.96	0.96	0.94	0.93

Source: Research findings

The results for the efficiency of date growers in Suran District as they were derived from DEA window model are shown in Table 4. The average efficiency of 45 studied farmers was 0.95 in this city. Again, this is close to 1 with respect to the consumed inputs, showing that these farmers have a high efficiency score and yield per unit area which endows them with high profit. Likewise, they showed consistent efficiency scores during the studied period.

Table 4: Results of Estimation of Efficiency Using DEA Window Analysis Technical in Sib District

Time interval	2012	2013	2014	2015	2016	Mean efficiency per window	Mean efficiency per year
Mean	0.96	0.97	0.96	0.96	0.95	0.96	0.92

Source: Research findings

Table 5: Results of Estimation of Efficiency Using DEA Window Analysis Technical in Saravan County

Time Interval	2012	2013	2014	2015	2016	Mean Efficiency Per Window	Mean Efficiency Per Year
Mean	0.97	0.97	0.96	0.97	0.96	0.97	0.95

Source: Research findings

Using the results of this research, highly efficient date farmers can be selected and supported to motivate them to improve their yields and profits even more, whereas traditional analysis methods do not allow such selection readily. In fact, in traditional analysis, it is impossible to aggregate the various results of input evaluations and to decide on the superiority of one farmer over other the farmers.

5. Conclusions

In the present study, we used the non-parametric DEA technique as an effective tool for the assessment of DMU's that has several similar inputs and outputs. We emphasized the non-parametric approach (dynamic DEA approach). Dynamic DEA approach is a method based on linear programming that calculates the efficiency of a set of DMU's (the studied date growers) on the basis of input and output indicators, compares them, and distinguishes the efficient and inefficient units. The results of the study enable the manager of each DMU to identify the optimum quantity of inputs and the strengths and weaknesses of the respective unit and to seek approaches to improve the unit efficiency. We always seek higher efficiency so as to accomplish higher profit or utility. Economically, efficiency means optimal allocation of resources, maximum exploitation of resources, and minimum cost with the existing facilities.

The planting area, recruited and family labor, irrigation frequency, manure, chemical fertilizer, age, educational level, experience, household size, non-date growing activities, number of land parcels, date tree interspacing, attendance at promotional courses, and orchard size were considered as the input indicators and the crop yield and profit were considered as the output indicators over the period 2012-2016.
Given the nature of the model (output-orientedness), it is assumed that date growers of the county maximize their profit and yield at a specific level of inputs. Thus, inefficient farmers should save the use of inputs to realize technical and scale efficiency. In other words, technical inefficiency is not merely caused by the shortage of inputs, but non-optimal use of inputs and their improper combination is among the key challenges in the region. Therefore, to increase the inputs in the region, it is imperative to motivate the optimum use of the existing inputs.

6. Recommendations

- It is recommended to date growers with the performance close to one to use appropriate policies in order to take fundamental steps towards perfect efficiency. The steps include the efficient and optimum use of improved varieties and seeds, suitable irrigation systems and the inputs like land, water, labor, etc.

- It is recommended to use modern technologies in agricultural sector including date growing sector. This solution will improve only productivity if it is accompanied with effective management and the holding of educational-promotional courses for local date growers to maximize the use of these resources.
- According to the results on efficiency or inefficiency of the units, it is necessary for date growers to move towards higher efficiency and for inefficient farmers to follow the practices used by reference units in order to move towards relative efficiency frontier.
- Given that the studied county is low developed from the technical perspective, it is useful to fulfill supportive policies in the region to enhance the technology efficiency.

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